14 Supp. Appeal Brief

V Brown
8/16/02

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant: Donald L. Chubb et al.

Serial No.: 09/323,650 Art Unit: 2859

Filed: June 1, 1999

Title: RARE EARTH OPTICAL TEMPERATURE SENSOR

Examiner: Lydia M. De Jesus

Docket No.: LEW 16,682-1

SUPPLEMENTAL APPELLANT'S BRIEF

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

This is an ex parte appeal from the May 8, 2002 decision of the Examiner rejecting claims 1-17 in the above-identified application.

REAL PARTY IN INTEREST:

The United States of America as represented by the Administrator of the National Aeronautics and Space Administration, Washington, DC (US) is the assignee of the application.

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Kent N Stone

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RELATED APPEALS AND INTERFERENCES:

None.

STATUS OF THE CLAIMS:

Claims 1 - 17 are pending. Claims 1-17 are rejected. Claims 1-17 are on appeal.

STATUS OF AMENDMENTS:

No amendment was filed after final rejection.

SUMMARY OF THE INVENTION:

The invention is an optical temperature sensor that includes a selective emitter 12, a light pipe 14, an optical bandpass filter 16 and a detector 18.

Selective emitters are devices for converting thermal energy into narrow band radiation (page 1, lines 15-16). The selective emitter 12 has a selective energy emission band, i.e., the emitter emits energy within the emission band in response to the temperature of the emitter 12 (page 3, lines 2-5). This is in contrast to most solid state materials, which have nearly constant spectral emittance (page 1, lines 16-17).

The emitter 12 emits energy in a selective energy emission

band in response to the temperature of the emitter. The light pipe 14 has a first end communicating with the emitter 12 and the second end communicating with the filter 16. The filter 16 has a pass band that is within the selective energy band of the emitter 12. The detector 18, communicating with the filter 16, detects the emitted energy as a measure of temperature of the emitter 12.

The claimed combination achieves high accuracy temperature measurement by using an emitter 12 that emits energy in a selective energy emission band (page 3, lines 2 - 10). This enables the filter 16, working within the emission band, to pass a high proportion, if not most, of the emitted energy while readily blocking extraneous optical radiation energy (page 3, lines 18 - 22). Consequently, the detector 18 sees a relatively error-free energy value or temperature signal coming from the emitter 12 (page 6, lines 12 - 14). Stated more simply, because the emitter 12 converts the thermal energy into a narrow band, the filter 16 is enabled to more readily pass all of what the emitter 12 emits and essentially only what the emitter 12 emits to produce an accurate temperature signal at the detector 18. The selective emitter/filter combination has the effect of substantially improving the signal to noise ratio in the sensor 10 (page 6, lines 14 - 16). Various materials are disclosed and claimed for

the construction of the emitter 12, light pipe 14, and detector 18.

ISSUES:

1. Whether claims 1, 10, 13, 16 and 17 are unpatentable under 35 USC 102(b) as anticipated by Dils (U.S. Patent No. 4,576,484).

2. Whether claims 2, 3 and 6 are unpatentable under 35 USC 103(a) over Dils in view of Rose et al. (U.S. Patent No. 5,447,786, hereinafter Rose).

3. Whether claims 4, 5 and 7-9 are unpatentable under 35 USC 103(a) over Dils in view of Milstein et al. (U.S. Patent No. 5,601,661, hereinafter Milstein).

4. Whether claim 11 is unpatentable under 35 USC 103(a) over Dils in view of Stone (U.S. Patent No. 4,523,315).

5. Whether claim 12 is unpatentable under 35 USC 103(a) over Dils in view of Tregay (U.S. Patent No. 4,794,619).

6. Whether claims 14 and 15 are unpatentable under 35 USC 103(a) over Dils in view of Readhead (U.S. Patent No. 4,625,389).

GROUPING OF THE CLAIMS:

ARGUMENT:

Issue 1

Dils teaches the use of a blackbody cavity 12 to generate a signal for temperature measurement. A blackbody (which is approximated by a blackbody cavity) inherently emits energy at a wavelength that is a function of its temperature. See, e.g., col. 4, equation 1 or Rose, col. 1, line39 to col. 2, line 3. Unfortunately, it is relatively difficult to measure wavelength. Instead, Dils uses a narrowband filter 22 to take a slice of the emission bandwidth of interest. Within this slice, sufficient intensity versus temperature dependence can be found to use an intensity detector 24 to produce a temperature measurement. For example, for a cavity 12 with a bandwidth of 0.7 microns (0.3 microns to 1.0 microns) (col. 2, lines 1-9), a narrowband filter 22 may have a bandwidth of 0.1 microns (col. 8, lines 24-25). This narrow slice of the emission bandwidth is then measured by the sensor 24 and converted to a temperature reading. However, the blackbody cavity 12 will emit energy across the entire bandwidth as a function of temperature, not just within the passband of the narrowband filter 22. The energy outside the passband is wasted in terms of helping the signal to noise ratio, etc. of the temperature measurement.

Claim 1 defines an optical temperature sensor that comprises

"an emitter having a selective energy emission band, said emitter converting thermal energy to energy within said emission band in response to a temperature of said emitter". Selective emitters are devices for converting thermal energy into narrow band radiation (page 1, lines 15-16). The selective emitter 12 has a selective energy emission band, i.e., the emitter emits energy within the emission band in response to the temperature of the emitter 12 (page 3, lines 2-5).

A selective emitter is the antithesis of a blackbody. It is in a sense "pre-sliced" (and the "slice" includes all of the energy being emitted). The selective emitter does not emit energy at a wavelength that is a function of the emitter's temperature. The wavelength/bandwidth is a function of the material itself. See, e.g., page 3, lines 7-10. The selective emitter converts thermal energy (temperature) to a signal having an intensity that is representative of the temperature across the emitter's bandwidth. See, e.g., the equation for q_S on page 4. As a result of this, the filter 16 of the present invention is used for improving signal to noise ratio (page 6, lines 14-16), rather than being necessary to create the measurement signal as in Dils, i.e., "getting a slice".

The Examiner has taken the position that Dils includes a

selective emitter. Office Action, 5/8/02, page 2. As set forth above, it is respectfully submitted that this is not the case; Dils does not teach or suggest an emitter having a selective energy emission band as claimed in the present invention.

Because Dils lacks at least the above described element, the invention of claim 1 is not anticipated under 35 USC 102(b). "To anticipate under section 102, a prior art reference must disclose all the elements of the claimed invention or their equivalents functioning in essentially the same way". Shanklin Corp. v. Springfield Photo Mount Co., 521 F.2d 609, 187 U.S.P.Q. 129 (1st Cir. 1975).

Similarly, claims 10, 13, 16, and 17, which depend from claim 1, also lack at least the above described element and, therefore, are also not anticipated under 35 USC 102(b).

Issue 2

Regarding the rejection of claims 2, 3 and 6 under 35 USC 103(a) over Dils in view of Rose, applicants incorporate their arguments made in Issue 1 of this brief item. Since Dils fails to anticipate claim 1, dependent claims 2, 3 and 6 are patentable over the art of record. See *In Re Johnson*, F.2d 1070, 200 USPQ 199 (CCPA 1978) "Since dependent claims, when properly drafted,

are by nature less inclusive than their associated independent claims, and since we have found the independent claims to recite statutory processes under 35 USC 101, we reversed the board's holding as to claims 1 - 17...". There is no allegation that Rose suggests a modification of Dils that would render claim 1 obvious and, therefore, invalid over 35 USC 103(a).

Claims 2, 3 and 6 depend from independent claim 1. Claim 2 further requires that "said emitter contains a rare earth element". Claim 3 further requires that "said emitter is composed of yttrium aluminum garnet doped with a rare earth element". Claim 6 further requires that "said light pipe is composed of sapphire".

In rejecting claims 2, 3 and 6 under 35 USC 103(a), the Examiner has taken the position that Dils discloses the invention as claimed, but fails to disclose said emitter containing a rare earth element or being comprised of a rare earth oxide. Office Action, 5/8/02, page 4. For the reasons set forth above with respect to Issue 1 which are incorporated here, it is respectfully submitted that Dils does not teach or suggest an emitter having a selective energy emission band as claimed in the present invention. In addition, as the Examiner correctly states, Dils "fails to disclose said emitter containing a rare earth element or

being comprised of a rare earth oxide." Office Action, 5/8/02, page 4.

Rose teaches the structure and manufacture of selective emitters, including emitters containing rare earth elements or being comprised of a rare earth oxide.

The Examiner has taken the position that Rose also teaches "selective infrared line emitters for converting thermal energy into infrared energy, in accordance to the theory of blackbody radiation". Office Action, 5/8/02, page 4. It is respectfully submitted that col. 1, line 39, through col. 2, line 10, of Rose teaches theory concerning blackbody emitters, but then, in col. 2, lines 11-38, Rose compares and contrasts blackbody emitters with selective emitters.

Rose continues this comparing and contrasting of blackbody emission with selective emitters, for example, "the [selective emitter] material needs to have certain definite properties, chief of which is low emissivity . . . . Material which has a low emissivity is not a good black-body radiator. . . . [The material should be smooth] in order for the article to have less of the undesirable black-body radiation". Rose, col. 5, lines 11-26. As discussed in Issue 1, a selective emitter is the antithesis of a blackbody.

Based on the foregoing, it is clear that a selective emitter is not an equivalent to a blackbody. In addition, neither Dils nor Rose teach, suggest or motivate that a selective emitter can be used as a temperature sensor. Rose teaches the use of a selective emitter to convert thermal energy to infrared energy (See, e.g., col. 1, lines 27-31), but Rose is completely silent as to the use of a selective emitter as a temperature sensor. That a selective emitter can be used as an energy converter does not imply that it can be used as a temperature sensor. For example, consider the analogy: knowing how bright a light bulb is does not allow the measurement of the temperature of the electric company's boiler.

Dils does not teach the use of an emitter having a selective energy emission band as claimed in the present invention. Neither Dils nor Rose teach, suggest, or motivate the use of a selective emitter as a substitute for a blackbody in general, nor as a temperature sensor in particular.

There is no motivation found in either Dils or Rose to combine their teachings or, more particularly, to substitute the emitter of Rose for the emitter of Dils. See *In Re* Laskowski, 871 F.2d 115, 10 USPQ2d 1397 (Fed. Cir. 1989) "Although the Commissioner suggests that [the structure in the primary prior art

reference] could be readily modified to form the [claimed] structure, '[t]he mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification.'" It is respectfully submitted that claims 2, 3 and 6 are patentable under 35 USC 103(a).

Issue 3

With reference to the rejection of claims 4-5 and 7-9 applicants' arguments in Issue 1 of this brief item are incorporated here. Since Dils fails to anticipate parent claim 1, these dependent claims are patentable for that reason alone. See *In Re Johnson*, supra. There is no allegation that Milstein suggests a modification of Dils that would render claim 1 obvious and, therefore, invalid over 35 USC 103(a).

There is no motivation found in either Dils or Milstein to combine their teachings or, more particularly, to substitute the emitter of Milstein for the emitter of Dils. Milstein is concerned with converting thermal energy into light energy (e.g. column 4, lines 20 - 26) and gives no consideration or suggestion of temperature measurement - the subject of the present invention. Therefore, Milstein cannot provide any motivation for substituting their material for the emitter of Dils. See *In Re*

Laskowski, 871 F.2d 115, 10 USPQ2d 1397 (Fed. Cir. 1989) "Although the Commissioner suggests that [the structure in the primary prior art reference] could be readily modified to form the [claimed] structure, '[t]he mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification.'" The essential feature of Dills is a blackbody cavity 12. Substitution of the emitter of Milstein, which is not a blackbody cavity, into the device of Dils would render the Dils device inoperative since there would be no blackbody emission to be measured.

For all of the foregoing reasons, the rejection of claims 4,5 and 7-9 under 35 USC 103(a) as unpatentable over Dils in view of Milstein is in error.

Issue 4

Regarding the rejection of claim 11 under 35 USC 103(a) over Dils in view of Stone, applicants incorporate their arguments made in Issue 1 of this brief item. Since Dils fails to anticipate claim 1, dependent claim 11 is patentable over the art of record. See *In Re Johnson*, supra. There is no allegation that Milstein suggests a modification of Dils that would render claim 1 obvious and, therefore, invalid over 35 USC 103(a).

For the foregoing reasons, the rejection of claim 11 under 35 USC 103(a) is in error.

Issue 5

Regarding the rejection of claim 12 under 35 USC 103(a) over Dils in view of Tregay, applicants incorporate their arguments made in Issue 1 of this brief item. Since Dils fails to anticipate claim 1, dependent claim 12 is patentable over the art of record. See *In Re Johnson*, supra. There is no allegation that Tregay suggests a modification of Dils that would render claim 1 obvious and, therefore, invalid over 35 USC 103(a).

For the foregoing reasons, the rejection of claim 12 under 35 USC 103(a) is in error.

Issue 6

Regarding the rejection of claims 14 and 15 under 35 USC 103(a) over Dils in view of Readhead, applicants incorporate their arguments made in Issue 1 of this brief item. Since Dils fails to anticipate claim 1, dependent claim 11 is patentable over the art of record. See *In Re Johnson*, supra. There is no allegation that Readhead suggests a modification of Dils that would render claim 1 obvious and, therefore, invalid over 35 USC 103(a).

For the foregoing reasons, the rejection of claim 11 under 35 USC 103(a) is in error.

CONCLUSION:

For all of the foregoing reasons, it is respectfully submitted that the presently claimed invention is neither anticipated nor obvious in light of the cited references. Reversal of the Examiner's final rejection and allowance of all claim is requested.

If there are any further fees required by this communication not covered by the enclosed check, or if no check is enclosed, please charge the same to Deposit Account No.14-0116.

Respectfully submitted,

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APPENDIX A

1. An optical temperature sensor, said sensor comprising:

an emitter having a selective energy emission band, said emitter converting thermal energy to energy within said emission band in response to a temperature of said emitter;

a light pipe having a first end and a second end, said first end communicating with said emitter;

an optical bandpass filter communicating with said second end, said filter having a pass band within said emission band; and

a detector communicating with said filter, said detector detecting said emitted energy as a measure of said temperature.

2. An optical temperature sensor according to claim 1, wherein said emitter contains a rare earth element.

3. An optical temperature sensor according to claim 1, wherein said emitter is composed of a rare earth oxide.

4. An optical temperature sensor according to claim 1, wherein said emitter is composed of a rare earth aluminum garnet.

5. An optical temperature sensor according to claim 1, wherein said emitter is a high temperature host material which is doped with a rare earth element.

6. An optical temperature sensor according to claim 3, wherein said rare earth oxide is ytterbium oxide.

7. An optical temperature sensor according to claim 5, wherein said host material is yttrium aluminum garnet which is doped with a rare earth element.

8. An optical temperature sensor according to claim 7, wherein said dopant is ytterbium.

9. An optical temperature sensor according to claim 5, wherein said emitter is composed of yttrium oxide doped with ytterbium.

10. An optical temperature sensor according to claim 1, wherein said light pipe is composed of sapphire.

11. An optical temperature sensor according to claim 1, wherein said light pipe is composed of yttrium oxide.

12. An optical temperature sensor according to claim 1, wherein said light pipe is composed of quartz.

13. An optical temperature sensor according to claim 1, wherein said detector is a silicon detector.

14. An optical temperature sensor according to claim 1, wherein said detector is a lead sulfide detector.

15. An optical temperature sensor according to claim 1, wherein said detector is an indium antimonide detector.

16. An optical temperature sensor according to claim 1, wherein said sensor operates at temperatures above 2,000°K.

17. An optical temperature sensor according to claim 1, wherein said sensor operates at temperatures between 625°K and 2683°K.